47-90

KEITHLEY INSTRUMENTS, INC.

INSTRUCTION MANUAL

MODEL 4103

ELECTRONIC TRIP

WARRANTY

We warrant each of our products to be free from defects in material and workmanship. Our obligation under this warranty is to repair or replace any instrument or part thereof (except tubes and batteries) which, within a year after shipment, proves defective upon examination. We will pay domestic surface freight costs.

To exercise this warranty, call your local field representative or the factory, DDD 216-795-2666. You will be given assistance and shipping instructions.

REPAIRS AND RECALIBRATION

Keithley Instruments maintains a complete repair service and standards laboratory in Cleveland, and has an authorized field repair facility in Los Angeles.

To insure prompt repair or recalibration service, please contact your local field representative or the plant directly before returning the instrument.

Estimates for repairs, normal recalibrations, and calibrations traceable to the National Bureau of Standards are available upon request.

CONTENTS

	SECTION
INTRODUCTION.....	I
SPECIFICATIONS.....	II
DESCRIPTION.....	III
OPERATION.....	IV
MAINTENANCE.....	V

Schematic Diagram
Voltage Resistance Chart
Replaceable Parts List

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06127

SECTION I - INTRODUCTION

The Keithley Model 4103 is an electronic relay designed for use with the 400 series Micro-microammeters. The Model 4103 is a completely self-contained instrument operating from the 117 Volt A.C. line and capable of being installed in the 400 series Micro-microammeter cabinet.

The 4103 Electronic Relay is a sensitive direct D.C. current voltage discriminator which actuates an electro-magnetic relay when a predetermined voltage level is reached. It is designed to be fail-safe for a signal which exceeds the trip point or for a signal which decreases below the trip point.

The 4103 differs from meter type relays in that it employs a high gain transistorized amplifier to control the relay. It is fail-safe in that any power failure will create the alarm condition.

SECTION II - SPECIFICATIONS

Trip Level:	Adjustable (by means of a potentiometer mounted on the Front Panel). 0.3 to 5 volts D.C. With resistance dividers, the range can be extended for 0.3 to 75 volts d.c. or higher.
Trip Level Polarity:	Positive or Negative
Input Resistance:	Greater than 5000 ohms.
Trip Level:	Both high level and low level trips are available. High level trip for increasing signal level. Low level trip for decreasing signal level.
Operating Temperature Range:	0 to +50° C.
Trip Point Stability:	0.02%/°C.
Speed of Response:	10 milliseconds.
Trip Level Sensitivity:	The differential between 'operate' and 'release' is approximately 50 millivolts.
Output:	Double pole, double throw relay, at 115 Volt A.C. Contacts: 5 amperes resistive at 115 Volt A.C.
Trip Reset:	Locking Type - The Model 4103 must be manually reset (push-button) to return to normal operation after being tripped.
Trip Indication:	Pilot Light - on Front Panel of 400 series, Micro-microammeter.
Trip Level Repeatibility:	The trip level repeatibility is stable to within ±10 mv dc, at constant temperature.
Voltage Reference:	1N935 Motorola silicon reference diode.

Transistor Compliment:	1--TI494, 3--2N651, and 1--2N1183.
Dimensions:	$4\frac{1}{4}$" length x 2 5/8" width x 2 1/8" height.
Weight:	Approximately, 14 ounces.
Mounting:	4 mounting holes - use 6-32 screws.

SECTION III - DESCRIPTION

MODEL 4103, ELECTRONIC RELAY:

The Model 4103, Electronic Relay consists of a four stage direct coupled transistorized amplifier. The first stage utilizes a silicon transistor to ensure reliable drift-free operation. The second stage consists of a differential stage which also provides good temperature stability while permitting the 4103 to operate as a high level trip or a low level trip. The third transistor stage is an emitter follower driving the output power transistor. The electromagnetic relay is in the collector circuit of the common emitter output stage. In normal operation the relay coil is energized so that any power failure will create an alarm condition.

The voltage reference consists of a silicon zener reference diode across which is placed the "SET LEVEL" control. The temperature coefficient of the silicon zener diode is 0.01%/°C. The Model 4103 contains its own power supply for operation from 115 volt A.C. or 230 volt A.C. 60 cps.

All leads for determining the specific type of relay operation desired are brought out to a 13 terminal barrier strip on the top cover of the unit. This permits changing the type of trip level and polarity without necessitating the removal of the housing for internal wiring changes.

POWER CONNECTIONS:

The A.C. line terminals are wired for 115 volt A.C., 60 cycles. Connect the "high" (black) side of the line to terminal #10 and the "low" (white) side to terminal #12. If a three wire line cord is used, connect the ground (green) side to the chassis of the 4103. This can be easily accomplished by connecting a spade type ground lug to any one of the four screws by which the chassis cover is fastened. The ground wire of the line cord is then soldered to this lug.

For conversion to 220 line voltage, consult wiring schematic. Terminal #11 is provided for wiring the transformer primary when 220 volt A.C. is required.

NOTE: An 8 AG 1/16 Ampere instrument fuse is used for 115 volt A.C. or 230 volt A.C.

INPUT CONNECTIONS:

Connection to the 4103 input is made by means of terminals number (4) and (5).

1) Polarity:

For polarity Wiring Terminations, see Table I, below:

TABLE I INPUT POLARITY WIRING TERMINATIONS

Input Polarity	Signal Lead Wired to:	Ground Lead Wired to:
Positive	Terminal #5	Terminal #4
Negative	Terminal #4	Terminal #5

2) Level Sensitivity:

The 4103 is wired for 5 volts, full scale sensitivity. If it is desired to decrease the sensitivity, provisions are made on the barrier strip for an input dropping resistor. Consult Table II and Drawings #13928A and #13920A.

TABLE II TRIP LEVEL SENSITIVITY

Full Scale Voltage Sensitivity	Input Resistor Value
	RA
5 V	0
10 V	5K
20 V	15K
50 V	45K
75 V	70K

3) Trip Level:

The 4103 is wired as a "high" level trip - it will create an alarm condition for an increasing input signal level. To convert to a "low" level trip see Table III below:

TABLE III TRIP LEVEL WIRING TERMINATIONS

Trip Level	Terminal wiring arrangement
Low Level or Decreasing	Wht-Org Lead to Terminal #7
High Level or Increasing	Wht-Orn. Lead to Terminal #6

4) Relay Output Terminals:

The Model 4103 provides the user with a DPDT set of relay contacts for use in controlling various operations. The relay is connected to the separate six terminal barrier strip on the top of the chassis. For the proper connections consult the wiring schematic Drawing #13929A.

NOTE: The relay is shown in the normal (energized) position.

WIRING THE FRONT PANEL CONTROLS:

The Model 4103, Electronic relay is primarily intended as an accessory to the Keithley 400 Series Micro-microammeters. Therefore, provisions are made on the front panel for "SET LEVEL" control and the "PUSH TO RESET" pilot light.

A. "SET LEVEL" Control: The "SET LEVEL" control is a 1.5 K Wire Wound 2 watt potentiometer. The wiring diagram is shown in Drawing #13936A.

B. "PUSH TO RESET" Pilot Light: The "PUSH TO RESET" pilot light is a combination neon pilot light and push button. The pilot light lights when the 4103 is in the "alarm" condition. To reset the 4103, the pilot light lens is depressed. This closes the contacts of the spring action push button which completes the collector circuit of the output transistor, thereby energizing the relay coil and returning the instruments to normal operation. The relay will not be energized if the trip signal level remains greater than the pre-determined trip point.

Also the 4103 will not return to normal operation when the input signal level returns to some value less than the trip point if the reset button is not depressed. To summarize the 4103 has locking action with manual reset.

The wiring diagram for the Push Button Pilot Light is shown in Drawing #13936A.

SECTION V - MAINTENANCE

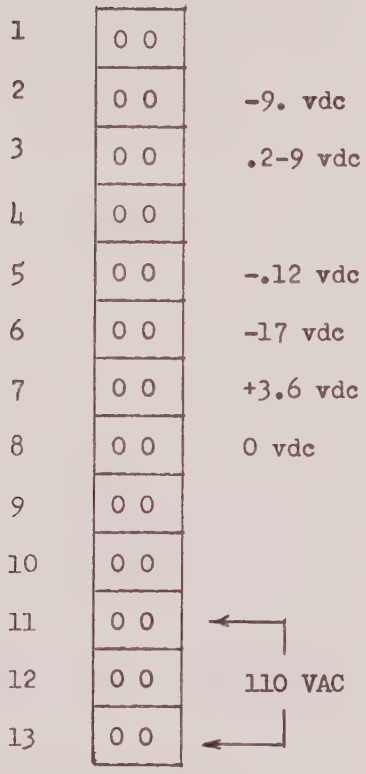
The Model 4103 is virtually maintenance free. There are no internal calibrations necessary or batteries to be replaced. If the highest reliability is required, it is recommended that the relay be replaced after every 500,000 operations.

Circuit Desig.	Description	Part No.
C-101	Capacitor, Electrolytic, 50 mfd at 25 vdc	C65-50
C-102	Capacitor, Same as C-101	
D-101	Rectifier, Silicon, 200 v, 750 ma	RF-20
D-102	Rectifier, Same as D-101	
D-103	Rectifier, Same as D-101	
D-104	Rectifier, Same as D-101	
D-105	Rectifier, Same as D-101	
D-106	Rectifier, Same as D-101	
D-107	Rectifier, Same as D-101	
D-108	Rectifier, Same as D-101	
D-109	Rectifier, Same as D-101	
D-110	Diode, Silicon Zener Reference	DZ-7
F -1	Fuse, 1/8 Ampere, 8AG,	FU-5
Q-101	Transistor, Silicon, 25 v, 150 mw	TG-10
Q-102	Transistor, Germanium, 30 v, 250 mw	TG-9
Q-103	Transistor, Same as Q-102	
Q-104	Transistor, Same as Q-102	
Q-105	Transistor, Germanium Power, 30 v @ 1 watt	TG-11
R-101	Resistor, Deposited Carbon, 5 v, 1%, ½ w	R12-5K
R-102	Resistor, Composition, 10 K , 10%, ½ w	R1-10K
R-103	Resistor, Same as R101	
R-104	Resistor, Composition, 3.3K, 10%, ½ w	R1-3.3K
R-105	Resistor, Same as R-102	
R-106	Resistor, Composition, 4.7K, 10%, ½ w	R1-4.7K
R-107	Resistor, Same as R102	
R-108	Resistor, Composition, 2.2K, 10%, ½ w	R1-2.2K

REPLACEABLE PARTS LIST - MODEL 4103

Circuit Desig.	Description	Part No.
R-109	Resistor, Same as R108	
R-110	Resistor, Same as R106	
R-111	Resistor, Same as R108	
R-112	Resistor, Composition, 1. K, 10%, ½ w	R1-1.2K
R-113	Potentiometer, 3 K, w.w, 2 w	RP-3.3K
RE-1	Relay, 4PDT, 12 VDC	RL-13
S -1	Push Button Pilot Light Switch, Neon	PL-19
T-1	Terminal Strip, 13 Terminal	TE-38
T-2	Terminal Strip, 6 Terminal	TE-39
TC-1	Transformer, Power, Central #K1-166	TR-38

MODEL 4103 VOLTAGE CHART



The above voltage readings were taken at the following conditions:

1) Relay energized (not tripped).

2) No input signal.

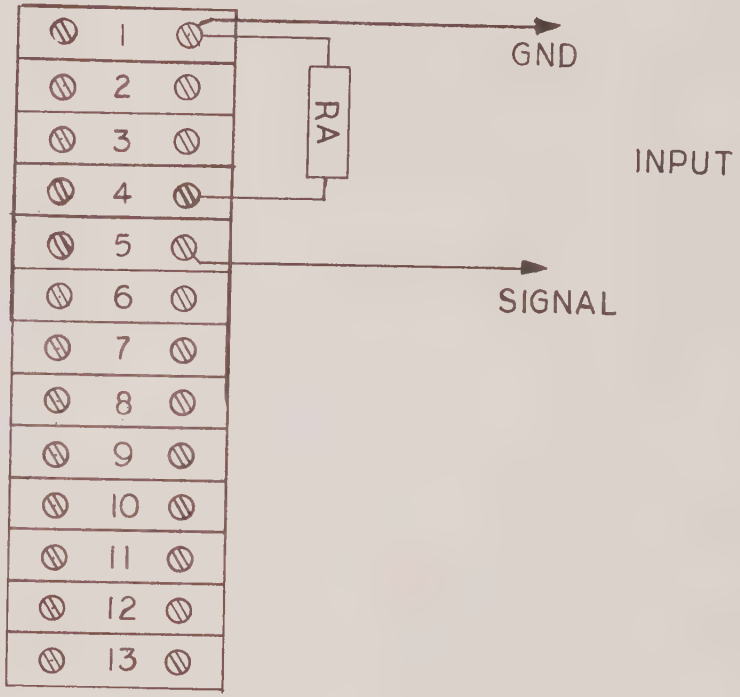
3) High level trip conditions.

4) Positive input.

5) VTVM ground on terminal #4.

Voltages readings taken with VTVM.

REVISIONS		
SYM	DESCRIPTION	DATE



4103-20	16011M	
4103	13892M	
MODEL	B/M	NEXT ASSEM.
USED ON		

MATERIAL

FINISH

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED

FRAC.	DEC.	ANG.
± 1/64	± .005	± 30'

TITLE

WIRING DIAGRAM, VOLTAGE SENSITIVITY POSITIVE INPUT SIGNAL

KEITHLEY INSTRUMENTS, INC.
CLEVELAND, OHIO

SCALE N.T.S.

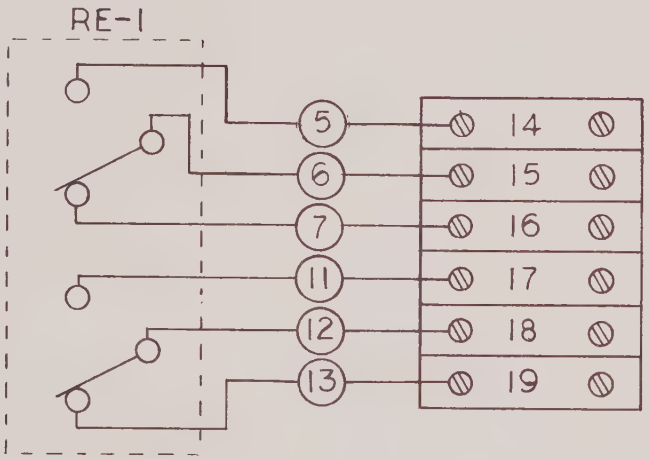
NO. REQ'D

NEXT ASSY.

DRAWN	JAC	DATE 9-30-60
CHECKED	cm	DATE 9-20-60
APPROVED	RMF	DATE 10-21-60

ISSUE	DRAWING NUMBER	SIZE
	13928A	

REVISIONS		
SYM	DESCRIPTION	DATE



RELAY IS SHOWN IN ENERGIZED POSITION

9103-20	16053M	
9103	13892M	
MODEL	B/M	NEXT ASSEM.
USED ON		

MATERIAL

FINISH

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED

FRAC.	DEC.	ANG.
± 1/64	± .005	± 30'

TITLE

WIRING DIAGRAM, RELAY OUTPUT

KEITHLEY INSTRUMENTS, INC.
CLEVELAND, OHIO

SCALE N.T.S. NO. REQ'D

NEXT ASSY.

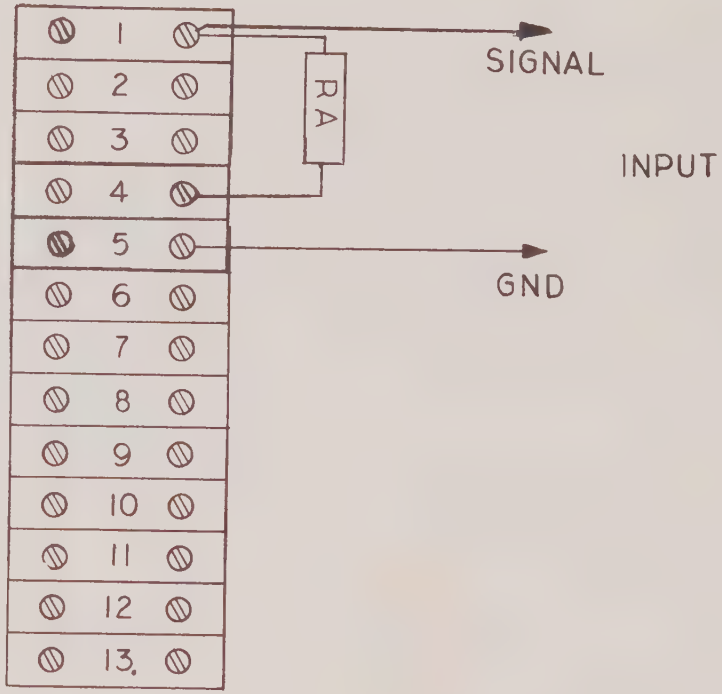
DRAWN [illegible] DATE 9-29-60

CHECKED cm DATE 9-20-60

APPROVED K.M.F. DATE 10-24-60

ISSUE	DRAWING NUMBER	SIZE
	13929A	

REVISIONS		
SYM	DESCRIPTION	DATE



4103-20	16011M	
4103	13811M	
MODEL	B/M	NEXT ASSEM.
USED ON		

MATERIAL

FINISH

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED

FRAC.	DEC.	ANG.
± 1/64	± .005	± 30'

SCALE N.T.S. NO. REQ'D

NEXT ASSY.

TITLE

WIRING DIAGRAM,
VOLTAGE SENSITIVITY
NEGATIVE INPUT SIGNAL

DRAWN [illegible] DATE 9-30-60

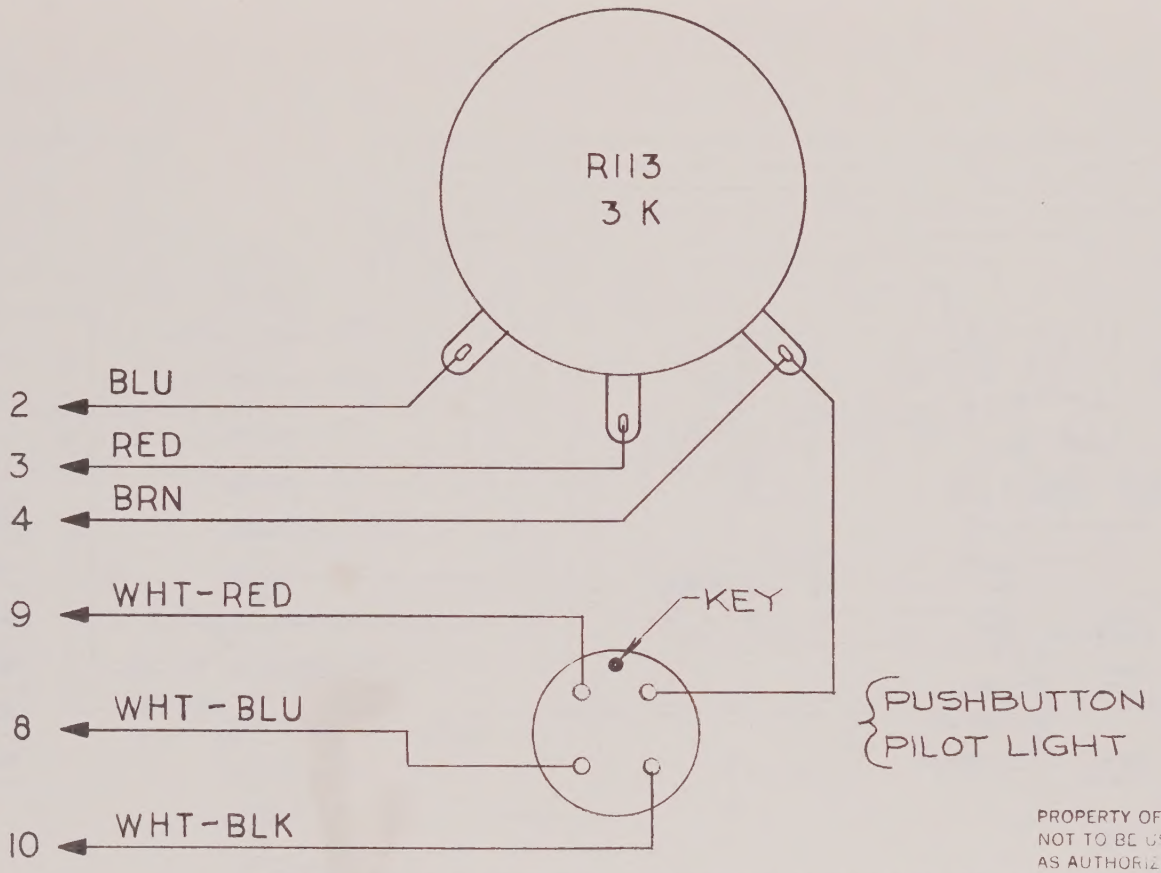
CHECKED cm DATE 9-20-60

APPROVED [illegible] DATE 10-21-60

KEITHLEY INSTRUMENTS, INC.
CLEVELAND, OHIO

ISSUE	DRAWING NUMBER	SIZE
	13930A	

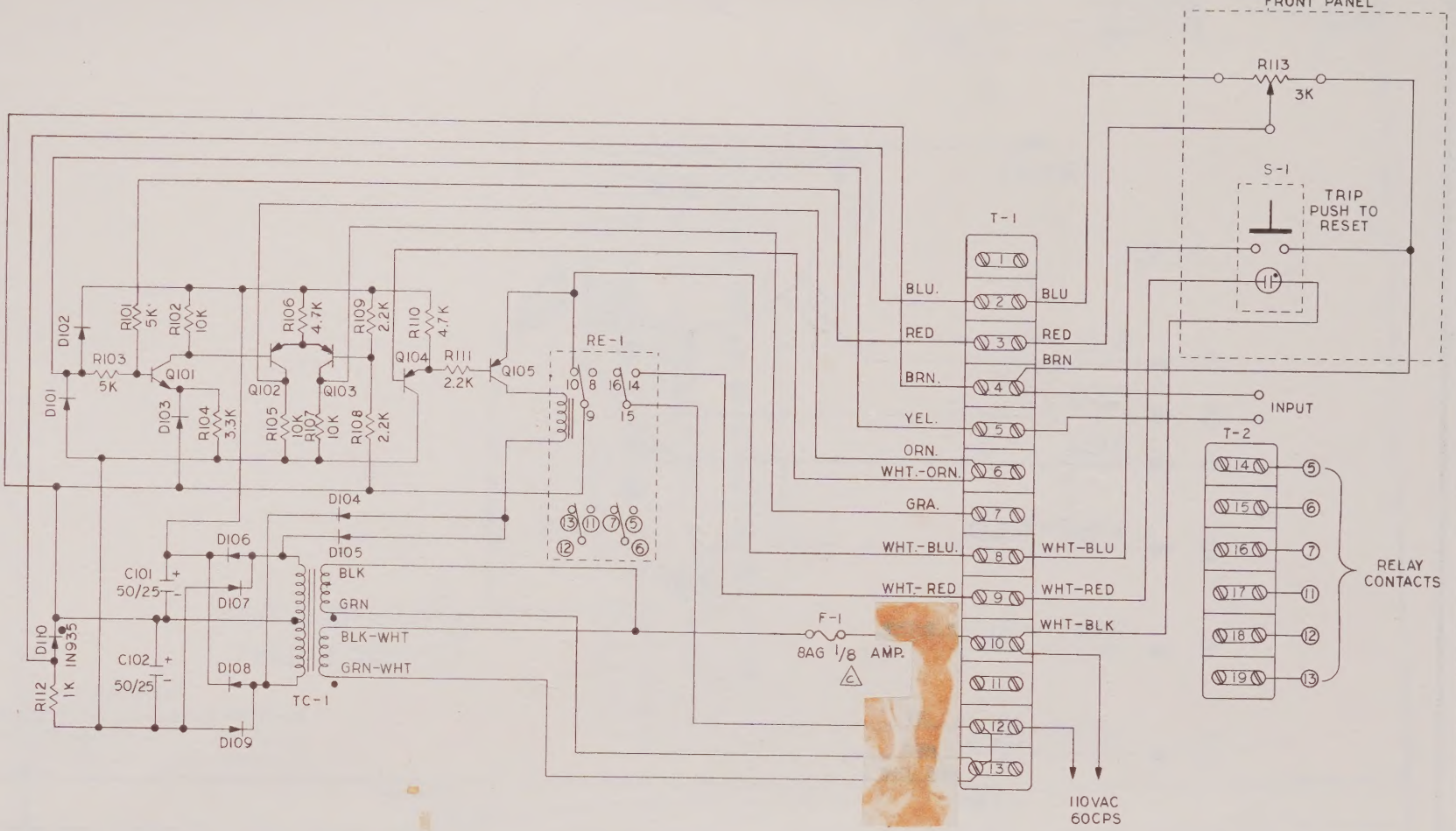
REVISIONS		
SYM	DESCRIPTION	DATE



CONFIDENTIAL
PROPERTY OF KEITHLEY INSTRUMENTS, INC.
NOT TO BE USED OR REPRODUCED EXCEPT
AS AUTHORIZED BY THE COMPANY.

MATERIAL			FINISH		
DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED			TITLE		
FRAC.	DEC.	ANG.	MODEL 4103 WIRING DIAGRAM, FRONT PANEL		KEITHLEY INSTRUMENTS, INC. CLEVELAND, OHIO
± 1/64	± .005	± 30'			
SCALE N.T.S.	NO. REQ'D		DRAWN [illegible] DATE 10-5-60	ISSUE	DRAWING NUMBER 13936A
NEXT ASSY.			CHECKED [illegible] DATE 10-20-60		SIZE
			APPROVED [illegible] DATE 10-21-60		

REVISIONS		
SYM	DESCRIPTION	DATE
A	ECO 1026 cm	2-17-61
B	ECO 1094 cm	4/29/61
C	ECO 1194 cm	10/16/61



NOTE:
D101-109 = IN2069 OR IN3193 (B)
Q101 = T1494
Q102,3,4 = 2N651
Q105 = 2N1183
RE-1 SHOWN IN ENERGIZED POSITION

CONFIDENTIAL
PROPERTY OF KEITHLEY INSTRUMENTS, INC.
NOT TO BE USED OR REPRODUCED EXCEPT
AS AUTHORIZED BY THE COMPANY.

MODEL	B/M	NEXT ASS'M.
4103	13892M	13927C

USED ON

MATERIAL — FINISH

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED

FRAC.	DEC.	ANG.
± 1/64	± .005	± 30'

SCALE — NO. REQ'D

NEXT ASSY. 13927C

TITLE: SCHEMATIC ELECTRONIC TRIP MODEL 4103

DRAWN — DATE 9-26-60
CHECKED cm — DATE 10-20-60
APPROVED — DATE 10-21-60

KEITHLEY INSTRUMENTS, INC.
CLEVELAND, OHIO

DRAWING NUMBER 13893C

KEITHLEY INSTRUMENTS, INC.

28775 AURORA ROAD • CLEVELAND, OHIO 44139 • (216) 248-0400
TELEX: 98-5469 • CABLE: KEITHLEY